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Separating Reflective and Fluorescent Components using High Frequency Illumination in the Spectral Domain

National Institute of Informatics [1], University of Tokyo[2], Kyushu Institute of Technology[3],

Ying Fu[2], Antony Lam[1], ○Imari Sato[1], Takahiro Okabe[3] , Yoichi Sato [2]

E-mail: imarik@nii.ac.jp

Hyperspectral imaging is beneficial to many applications but current methods do not consider fluorescent effects which are present in everyday items ranging from paper, to clothing, to even our food. Furthermore, everyday fluorescent items exhibit a mix of reflectance and fluorescence. So proper separation of these components is necessary for analyzing them. In this paper, we demonstrate efficient separation and recovery of reflective and fluorescent emission spectra through the use of high frequency illumination in the spectral domain. With the obtained fluorescent emission spectra from our high frequency illuminants, we then present to our knowledge, the first method for estimating the fluorescent absorption spectrum of a material given its emission spectrum. Conventional bispectral measurement of absorption and emission spectra needs to examine all combinations of incident and observed light wavelengths. In contrast, our method requires only two hyperspectral images. The effectiveness of our proposed methods are then evaluated through a combination of simulation and real experiments. We also demonstrate an application of our method to synthetic relighting of real scenes.

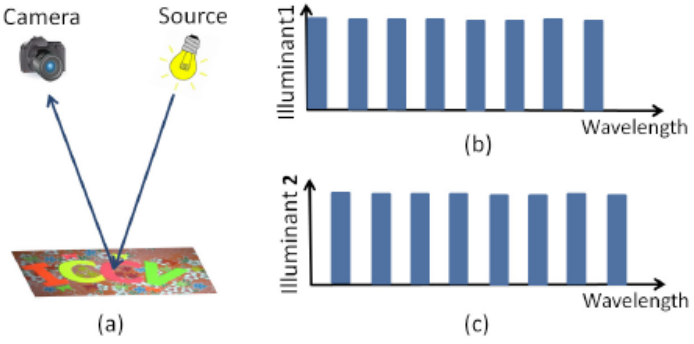

Figure　An example of a captured scene (a). When a reflective-fluorescent point in the scene is lit by the illuminant (b), which is a high frequency binary illumination pattern in the wavelength domain, each lit wavelength includes both reflective and fluorescent components while the unlit wavelengths have only the fluorescent component. (c) shows its complement.